MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2019/2020

PTM 0145 –TRIGONOMETRY

(Foundation in Information Technology / Foundation in Life Sciences)

15 OCTOBER 2019
9.00 a.m. – 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of **TWO** printed pages, excluding the front page and the appendix. Distribution of marks for each question is given.
2. Answer **ALL** questions.
3. Write your answers in the Answer Booklet.
4. All necessary workings **MUST** be shown.

Instructions: Answer **ALL FIVE** questions.

Question 1 [10 marks]

a. Given $z = -4 + 3i$ and $w = 5 - 4i$.
   i. Find the polar form of z and w. (4 marks)
   ii. Find the polar form of $\frac{w}{z}$ and $\left(\frac{w}{z}\right)^4$. (3 marks)

b. Solve the equation $x^2 + 4x + 5 = 0$ in the complex number system. Write the answer in the standard form $a + bi$. (3 marks)

Question 2 [10 marks]

a. Given the vertex of the parabola is (3, 6) and the directrix line is 2 units above the vertex.
   i. Sketch the graph of the parabola based on the above information and hence identify the axis of symmetry and the focus point. (3 marks)
   ii. Find the equation of the parabola and write the answer in $y = ax^2 + bx + c$. (2 marks)

b. Sketch the graph and identify the coordinates of the center, vertices and foci of the given function $\frac{(x-4)^2}{36} + \frac{(y+6)^2}{20} = 1$ (5 marks)

Question 3 [10 marks]

a. Given $A = \begin{bmatrix} 2 & 10 & -8 \\ -3 & 1 & -2 \\ 0 & 4 & 3 \end{bmatrix}$, $B = \begin{bmatrix} 7 & 2 & -3 \\ -4 & 2 & 9 \end{bmatrix}$ and $C = \begin{bmatrix} 3 & -1 & 5 \\ -2 & 6 & 1 \end{bmatrix}$.

   Find the matrices $(B + 3C)^T$ and A^2. (4 marks)

b. Solve the following system of linear equations by using the inverse matrix method.

$$\begin{aligned} 3x + 4y &= -13 \\ x + 2y - 5z &= 1 \\ 2x + 5z &= -21 \end{aligned}$$

(6 marks)

Continued…

Question 4 [10 marks]

a. Solve the equations, for $0^\circ \leq x \leq 360^\circ$.

i. $2\cos^2 x - \cos x - 1 = 0$. (3 marks)

ii. $\sin 2x + \dfrac{1}{\csc x} = 0$. (3 marks)

b. Find the exact value of $\cot\left(\cos^{-1}\left(-\dfrac{1}{4}\right)\right)$. Do not use a calculator. (2 marks)

c. Prove the identity: $2\cot x = \sin 2x \csc^2 x$. (2 marks)

Question 5 [10 marks]

a. Determine the amplitude, period and phase shift of the function:

$$y = \frac{3}{2}\sin\left(2x - \frac{\pi}{4}\right)$$

Then, draw the graph for the function above in 2 periods. Identify the minimum, maximum point and at least 2 x-intercepts. (6 marks)

b. Diagram 1 shows a triangle *CDE*.

i. Calculate the length of *CE*. (2 marks)

ii. Find the angle E and the area of the triangle. (2 marks)

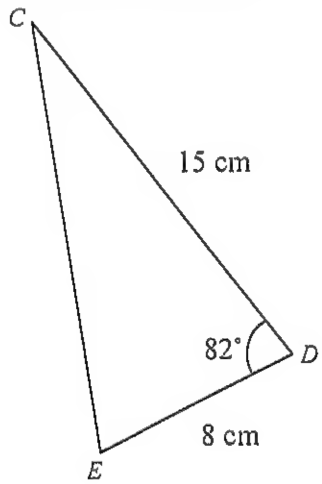


Diagram 1

End of Paper

APPENDIX

Trigonometry Identities

$\cos^2 A + \sin^2 A = 1$ $\quad$ $\sec^2 A = 1 + \tan^2 A$ $\quad$ $\csc^2 A = 1 + \cot^2 A$

$$\cos(A+B) = \cos A \cos B - \sin A \sin B$$
$$\cos(A-B) = \cos A \cos B + \sin A \sin B$$
$$\sin(A+B) = \sin A \cos B + \cos A \sin B$$
$$\sin(A-B) = \sin A \cos B - \cos A \sin B$$
$$\tan(A+B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$$
$$\tan(A-B) = \frac{\tan A - \tan B}{1 + \tan A \tan B}$$

$$\cos 2A = \cos^2 A - \sin^2 A$$
$$= 2\cos^2 A - 1 = 1 - 2\sin^2 A$$
$$\sin 2A = 2\sin A \cos A$$
$$\tan 2A = \frac{2\tan A}{1 - \tan^2 A}$$

$$\sin A \cos B = \frac{1}{2}[\sin(A+B) + \sin(A-B)]$$
$$\cos A \cos B = \frac{1}{2}[\cos(A+B) + \cos(A-B)]$$
$$\sin A \sin B = \frac{1}{2}[\cos(A-B) - \cos(A+B)]$$

$$\sin A + \sin B = 2\sin\frac{A+B}{2}\cos\frac{A-B}{2} \qquad \sin A - \sin B = 2\cos\frac{A+B}{2}\sin\frac{A-B}{2}$$

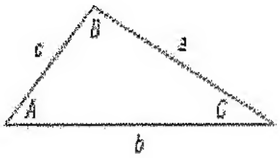
$$\cos A + \cos B = 2\cos\frac{A+B}{2}\cos\frac{A-B}{2} \qquad \cos A - \cos B = -2\sin\frac{A+B}{2}\sin\frac{A-B}{2}$$

$$\sin^2\frac{A}{2} = \frac{1-\cos A}{2} \qquad \cos^2\frac{A}{2} = \frac{1+\cos A}{2} \qquad \tan^2\frac{A}{2} = \frac{1-\cos A}{1+\cos A}$$

$$\sin\frac{A}{2} = \pm\sqrt{\frac{1-\cos A}{2}} \qquad \cos\frac{A}{2} = \pm\sqrt{\frac{1+\cos A}{2}} \qquad \tan\frac{A}{2} = \pm\sqrt{\frac{1-\cos A}{1+\cos A}}$$

$$\tan\frac{A}{2} = \frac{1-\cos A}{\sin A} = \frac{\sin A}{1+\cos A}$$

Triangles



Law of Sines:

$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

Law of Cosines:

$$c^2 = a^2 + b^2 - 2ab\cos C$$
$$b^2 = a^2 + c^2 - 2ac\cos B$$
$$a^2 = b^2 + c^2 - 2bc\cos A$$

Area of a Triangle: $A = \frac{1}{2}ab\sin C = \frac{1}{2}bc\sin A = \frac{1}{2}ac\sin B$

$A = \sqrt{s(s-a)(s-b)(s-c)}$ where $s = \frac{1}{2}(a+b+c)$

Polar Coordinates

$$x = r\cos\theta$$
$$y = r\sin\theta$$
$$r = \sqrt{x^2 + y^2}$$
$$\tan\theta = \frac{y}{x}$$